Adult Chinook Salmon Enumeration and Coded-wire Tag Recovery Analysis for Kincolith River, BC, 2002

B. E. Baxter, S. Sviatko, and B. Stewart

Fisheries and Oceans Canada
Room 202, 417-2nd Ave
Prince Rupert, BC
V8J 1G8

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Adult Chinook Salmon Enumeration and Coded-wire Tag Recovery Analysis for Kincolith River, BC, 2002

prepared by

B. E. Baxter[1], S. Sviatko[1], and B. Stewart[2]
LGL Limited
environmental research associates[1]

for

Nisga'a Lisims Government[2]

[1] 9768 Second St., Sidney, BC V8L 3Y8
[2]P.O. Box 228, New Aiyansh, BC V0J 1A0

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ABSTRACT

Baxter, B.E., S. Sviatko, and B. Stewart. 2005. Adult Chinook enumeration and coded-wire tag recovery analysis for Kincolith River, BC, 2002. Can. Manuscr. Rep. Fish. Aquat. Sci. 2712: vii + 46 p.

An instream floating fence in combination with video technology was used at the Kincolith River in 2002 to obtain accurate escapement estimates of returning salmon species. A total of 1,010 chinook were counted through the weir via video monitoring and direct observation. An additional 81 chinook were taken for broodstock and 251 chinook were harvested in the Nisga'a in-river angling fishery. Migration timing, mean length, and age composition of the returning adult chinook are presented. The adipose clip rate of returning chinook was estimated at 17%, based upon 980 chinook examined via video review. Escapement estimates of other species included: 14,016 pink and minimum escapement estimates of 82 chum, 370 coho, and 26 steelhead.

Canadian and US commercial harvests of Kincolith River hatchery chinook were examined using coded-wire tag recovery data obtained from the Mark-Recovery Program and the Alaska Department of Fish and Game (ADF&G) mark tag and age lab online searchable database. Exploitation rate for the 1996 brood year was estimated at 62.0% (35.1% Canadian, 26.9% US), with terminal harvests by Nisga'a anglers accounting for 12.4% of the total Canadian harvest. Exploitation rates for the 1997 and 1998 brood years are incomplete and will be revised based upon CWT recoveries in future years.

Of the total catch of Kincolith River chinook for brood year 1996, Canadian catch accounted for 56.6% and included 20% terminal harvest by Nisga'a anglers and the US catch accounted for an estimated 43.4%. Harvests occurred over a wide area ranging from S.E. Alaska to the US Northern Outside Statistical Area in Alaska (northwest of Juneau, AK), and Statistical Areas 1-5 for the Canadian Fisheries. Smolt-adult survival for the 1996 brood year was estimated at 1.0%.

RÉSUMÉ

Baxter, B.E., S. Sviatko, and B. Stewart. 2005. Adult chinook salmon enumeration and coded-wire tag analysis for Kincolith River, BC, 2002. Can. Manuscr. Rep. Fish. Aquat. Sci. 2712: vii + 46 p.

Nous nous sommes servis d'une barrière flottante en association avec la magnétoscopie en 2002 afin d'obtenir une estimation exacte de l'échappée des espèces de saumon qui retournaient à la rivière Kincolith. Nous avons compté un total de 1,010 saumons quinnat à la bordigue à l'aide de la surveillance vidéo et d'observation directe. Dans la rivière les Nisga'a ont pris 81 saumons quinnat supplémentaires pour le stock de géniteurs et 251 saumons quinnat furent capturés par la pêche à la ligne. Nous présentons la période de migration, la longueur moyenne et la composition selon l'âge des saumons quinnat adultes de retour. Le taux d'ablation de la nageoire adipeuse fut estimé à 17% pour les saumons quinnat en se fondant sur 980 saumons quinnat examinés au cours d'une revue vidéo. L'estimation de l'échappée des autres espèces comprenait : 14,016 saumons rose et une échappée minimum approximative de 82 saumons kéta, 370 saumons coho et 26 truites arc-en-ciel anadromes.

Les récoltes commerciales canadiennes et américaines de l'écloserie de la rivière Kincolith ont été examinées grâce aux données de récupération des marques magnétiques codées provenant du Programme de marquage-récupération et en directe de la base de données du Département de Pêche et Chasse de l'Alaska. Le taux d'exploitation pour l'année d'éclosion 1996 fut estimé à 62.0% (35.1% canadien, 26.9% États-Unis), les pêches à la ligne Nisga'a constituent 12.4% de la récolte totale canadienne. Les taux d'exploitation pour les années initiales 1997 et 1998 sont incomplets et seront revisés en se servant des données de récupération des marques magnétiques codées à l'avenir.

Durant l'année initiale 1996 les récoltes de saumons quinnat dans la rivière Kincolith furent divisées comme suit : le Canada en comptait 56.6%, y compris 20% de récolte par les pêcheurs Nisga'a, et les États-Unis en comptait approximativement 43.4%. Les récoltes couvraient un vaste secteur, s'étendant à partir du sud-est de l'Alaska jusqu'à la zone statistique nord extérieure de l'Alaska aux Etats-Unis (au nord-ouest de Juneau, AK) et la zone statistique 1-5 pour les pêches canadiennes. Le taux total de survie pour les saumoneaux/géniteurs pour l'année initiale 1996 fut estimé à 1.0%.

INTRODUCTION

The Kincolith River flows into Portland Inlet at the mouth of the Nass River. The Kincolith River produces coho (*Oncorhynchus kisutch*), chinook (*O. tshawytscha*), chum (*O. keta*) and pink (*O. gorbuscha*) salmon that are utilized by commercial, native and sport fisheries. Their population status and health is unknown, but suspected to be depressed from their historic levels (D. Peacock, DFO-Prince Rupert, pers. comm.). The Kincolith River enhancement project was initiated in 1979 to enhance coho and chinook salmon, and coded-wire tagging of a portion of the released chinook smolts began in 1986 (Table 1). Enhancement of coho was terminated in 1997 based on adequate wild coho juvenile abundance determined during 1996 FRBC assessment studies on the Kincolith River. The project was funded by the Community Economic Development Program (CEDP) of the Department of Fisheries and Oceans (DFO) Salmonid Enhancement Program (SEP). The Nisga'a Lisims Government operates the Kincolith River enhancement project as part of the Nisga'a Fisheries Program.

The specific objectives of the 2002 Kincolith River chinook exploitation rate indicator program were to:

1. Install a floating style weir in the Kincolith River and enumerate all returning species of salmon and steelhead (*O. mykiss*).
2. Use digital video technology to enumerate returning salmon species.
3. Document the timing, size, and age distribution of the chinook escapement.
4. Monitor the escapement for marked coded-wire-tagged (CWT) adult chinook, and determine oceanic exploitation and survival rates.

STUDY AREA

The Kincolith River originates between the Coast Mountains of the Boundary Ranges and flows southwest for approximately 42 km, entering the trifurcation point of the Nass River, Portland and Observatory inlets (Fig. 1).

The Kincolith River supports several species of salmonids including chinook, coho, pink, chum, steelhead and Dolly Varden (*Salvelinus malma*). Mean adult escapement estimates for Kincolith River chinook, coho, pink and chum salmon for the period of 1990-1999 are 648; 2,000; 11,667(odd year); 125, respectively (SEDS 2001; Salmon Escapement Database).

KINCOLITH CHINOOK AGE STRUCTURE

Scale samples from the 2001 Kincolith Fence program (Sviatko and Baxter 2002) indicated that approximately 93% of the returning adults that were successfully aged go to sea in their second year of life (Gilbert Rich age designation). This is consistent with previous years of age samples, with the exception of 1996, when two aged adult chinook indicated that they had gone to sea in their first year of life (Stephens et al. 1998, Stephens and Alexander 1999ab).

Approximately 66.5% of adults that have been successfully aged for the 1996, 1998, 2001 and 2002 return years have been 5 year olds with 6 year olds comprising 20.6% of the escapements (Table 2). The proportion of 4 year old males has comprised a larger percentage of the escapement when compared to females for the same return years. Age-3 and age-7 returns have averaged 1.1% and 0.5%, respectively for the four years of available age information.

CONTRIBUTIONS OF HATCHERY FISH TO ESCAPEMENT

Attempts at determining hatchery contributions of chinook and coho to total escapement have been met with mixed success over the years (Alexander and Bocking 1993. Escapement data for the Kincolith River have been poorly collected and documented which has led to uncertainty regarding contributions of hatchery fish to total escapements. An instream, floating weir was operated on the Kincolith River in the summer of 1995 and 1996 in an attempt to collect better information regarding adult returns and escapement and to determine hatchery contributions (Alexander 1997, Stephens et al. 1998). A total of 772 chinook were examined at the adult weir in 1995 and of these, 22 were missing their adipose fins and were considered hatchery fish, which resulted in a mark rate of 2.8% (Table A-1). In 1996, a total of 210 chinook were examined for adipose fin clip (AFC) and included catch in the food fishery below the weir, catch at the weir, and catch during escapement surveys (Stephens et al. 1998). Of the 210 chinook examined, eight were missing their adipose fins which led to a mark rate of 3.8%. Overall mark rates ranged from 2.8% in 1995 to 18.6% in 2002 for chinook recovered in the Nisga'a in-river angling fishery, brood stock collections and at the weir (Table A-1). Mark rates obtained in the in-river angling fishery and brood stock collections are likely biased. Caution is advised when looking at mark rates of returning chinook, as an estimated 77.25% of chinook released from the Kincolith hatchery, for brood years 1989 to 1994 were unmarked.

In 1999 and 2000, rotary trap studies were conducted to help assess the population size of wild chinook smolts emigrating from the Kincolith River (Bocking et al. 2000, 2001). Results from the 2000 study indicated that approximately 42.4% of the chinook smolts emigrating from the Kincolith River were wild. In 1999, the rotary trap study found that only 18.4% of the emigrating smolts were of wild origin.

METHODS

PHYSICAL OBSERVATIONS

Water temperature, velocity, level and weather were recorded daily. Daily water temperatures were collected from the Kincolith River using an alcohol-filled thermometer. Water velocity measurements were taken daily at a marked site approximately 10 m (33 ft) upstream of the weir and 5 m (16 ft) from the left bank. Surface water velocity was measured by timing the passage of a floating object over a fixed 10 m interval and averaging the results (n = 3). Water level was recorded from a staff gauge mounted on a wood abutment situated on the left bank of the river, beside the weir.

ADULT ENUMERATIONS

Adult Weir

An instream, floating weir which was operated on the Kincolith River for the 2001 season (Sviatko and Baxter 2002) was once again used for the 2002 season with slight modifications (Photo Plate 1). The weir spanned 52 m (170 ft) across the entire river and consisted of 37 panels hinged together. Each panel measured 6 m (20 ft) in length and 1.2 m (4 ft) in width and consisted of several PVC pipes attached together with fir cross members. Similar panels (10) of the same dimensions were constructed from 2 inch square aluminum tubing and PVC piping. The new panels replaced damaged panels consisting of rotten fir crossmembers. Panels were attached to a 10 mm cable that ran through eyelets of an angle-iron rail anchored into the substrate. The rail was secured to the bottom of the river by iron cross pieces affixed to 3/8" rebar and several strategically positioned duckbill anchors. An inflatable oil containment boom tube (fabricated by Canadyne Technologies Inc.) measuring 0.5 m (1.6 ft) in diameter and 52 m (170 ft) in length was attached to the downstream end of the panels for floatation. The floating panels swiveled on the substrate cable in response to changing water levels. The weir was also designed to be semi-self-cleaning as large, heavy debris could "roll" over the panels upon deflation of the floatation boom. Two trap boxes (1.8 m x 2.4 m x 1.7 m) made of aluminum pipes were anchored to the substrate with duckbill anchors. The first trap (trap #1) was positioned 1.2 m (4 ft) and the other (trap #2) was 5.5 m (18 ft) from the south shore (Photo Plate 2). The traps had two sliding doors on each end that allowed fish to enter from the downstream end and exit upstream. Knotless mesh attached the weir to the traps and guided fish into the downstream opening of the traps. Plywood was used to cover the traps and to provide a working platform. Video chambers were installed in each trap to provide a controlled environment for optimal picture quality of recorded fish passage.

Video Systems

Video chambers consisted of rectangular aluminum frames (2 ft x 4 ft x 5 ft) constructed from 1.5 inch square tubing with aluminum brackets welded to two sides of the frame and a sheet of expanded aluminum welded to the bottom. Plywood was permanently screwed to the upstream and downstream sides of the top of the frames, allowing fish passage along the bottom. Plywood was affixed to the shore sides of the frames via aluminum brackets to allow for the removal (Photo Plate 2). Plexiglas was inserted via the brackets on one side of the chamber near the bottom for the video camera to see through. A hinged plywood cover was also attached to each chamber. Underwater video cameras were mounted on the upstream end of the chambers in both traps to enumerate fish passing through. One monochrome camera (IAS Products Seemate U/W Camera) was mounted on the right side of the chambers and one was mounted on a fiberglass covered Styrofoam board floating in the top of the chambers (facing downstream).

Fish passage was recorded with a time-lapse digital video recorder (Silent Witness model # DVMS1600), recording at a rate of approximately 2.5 frames/second. Video was recorded 24 hours a day on 120 gigabyte hard drives and archived for documentation. Fish were counted by video review using the same video recorder (capable of recording and reviewing simultaneously) via a monitor located in the hatchery. A 13 inch monitor was also connected to the video

recorder to provide live viewing while recorded viewing was being conducted. Two white fluorescent lights totaling 8 watts each were installed underwater in each of the video chambers for night sampling and illumination of cameras. The inside of the video chamber was painted white to improve illumination. The digital video recorder was connected to an inverter and 12 volt battery bank to allow for consistent operation during power outages. The battery bank was connected to a charger allowing the batteries to remain at full charge at all times when power was available. The same battery system was connected to the cameras and lights to provide power during outages.

Video Counts

The recorded video was scanned for the presence or absence of fish using the digital video recorder at approximately 15 frames/second. Once the presence of a fish was detected, the video was played back frame per frame and/or paused allowing for species identification and adipose fin presence (Photo Plates 3, 4). The exact time of each fish passing through the weir was recorded by observers along with adipose fin presence on chinook. During times of high turbidity, image quality suffered and the weir was closed for short periods of time until viewing conditions improved.

Biosampling

Chinook captured in the Nisga'a in-river angling fishery were measured for post-orbital-hypural length and examined for fin clips and sex by the Nisga'a Fisheries catch monitor (Baxter and Azak 2003). Data collected from the catch monitor were used to calculate sex ratios and mean length by sex. Scale samples (five scales per fish) were taken from all chinook sampled and were sent to the Fisheries and Oceans Canada Scale Lab, Nanaimo, BC for age determination.

CODED-WIRE TAG RECOVERIES

Hatchery chinook smolts at Kincolith River were CWT and adipose fin-clipped (AFC) prior to release in the spring of 1996, 1997, 1998, 1999 and 2000 (Table 3, Alexander 1997, Stephens and Alexander 1998, Stephens and Alexander 1999a, Stephens and Alexander 1999b, Stephens 2002.

Commercial and Sport Harvests: Commercial and sport catches of CWT fish are monitored by the Fisheries and Oceans Canada and various US agencies and compiled in the Mark Recovery Program (MRP) and in the Alaska Department of Fish & Game (ADF&G) mark tag and age lab online searchable database. Data on CWT releases and recaptures are used to estimate the number of fish from a particular stock that have been harvested in the commercial and sport fishery, as well as determining the spatial and temporal distribution of harvests (Kuhn et al. 1988, Nass 1997a). The estimates include catch (observed catch corrected for sampling effort), expanded catch (estimated catch corrected for unmarked fish), exploitation rate (proportion of CWT chinook caught in the fishery), and total return (expanded catch plus escapement).

Geographic Distribution of Harvest: Coded-wire-tagged fish in the commercial catch are recorded by Canadian and US fishery Statistical Areas. To estimate the number of recoveries for each Canadian area, the observed CWT catch was expanded by the mean catch-sampling ratio observed in the Catch Region (e.g., Northern Troll = Stat Areas 1, 3, 4, and 6). Similarly, US troll catch was expanded using the catch sampling ratio by quadrant (e.g., northwest) and the net catch sampling ratios, by district.

Escapement: Crews examined all chinook recorded at the weir for the presence or absence of the adipose fin. The contribution and survival of AFC chinook to the escapement was determined using methods presented in Bocking et al. (1992) and modified in Nass (1997a). CWT heads were collected from fish recovered in the native angling fishery below the weir, broodstock collection and from carcass recoveries.

Nisga'a Food Social and Ceremonial (FSC) Harvests (angling)

In order to determine estimated CWT catch in the Nisga'a in-river angling fishery it was necessary to expand the observed CWT's recovered by using the following formula:

$$\text{Est. CWT} = \text{Obs. CWT} * \frac{(EH)}{(TOH)} \qquad (1)$$

where:

Obs. CWT is the observed number of CWTs recovered in the Nisga'a angling fishery, by brood year,
EH is the estimated harvest of chinook by Nisga'a anglers at the Kincolith River, and
TOH is the total observed harvest of chinook by Nisga'a anglers at the Kincolith River.

This expansion was used for the 2001 and 2002 return years.

RESULTS

PHYSICAL OBSERVATIONS

Water temperatures during the chinook migration at the Kincolith River ranged from a minimum of 5 °C in early June to a maximum of 10 °C in late August (Figure 2). During the period that the weir was operational, water level at the gauge ranged from 0.3m to 1.1m with an average level of 0.6 m. Water levels rose within short periods of time in direct relationship to large tides and heavy precipitation causing the weir to be topped on 2 August and 9 August. Water velocity during the monitored period ranged from a minimum of 0.30 m/s to a maximum of .91 m/s with an average velocity of 0.58 m/s. Velocities were not measured during peak water flows due to safety considerations.

ADULT ENUMERATIONS

Weir and Live Video Counts (chinook)

The weir was operated continuously from 6 June to 22 August. A total of 1,010 chinook were counted through the weir via video review (Table 4). A total of 171 adipose clipped chinook, 811 non clipped and 28 unknown (marks) were counted through the weir. Maximum daily migration past the weir was 84 chinook on 2 August (Figure 3, Table B-1). Exact times of chinook passing through the weir were grouped by hourly dial intervals to delineate chinook movement (Figure 4). Chinook showed peak movement through the weir between the hours of 18:00 to 01:00 in June and July (Fig. 4a, 4b). August migration through the weir displayed peak movements during the early morning hours 04:00-06:00 and mid afternoon, 13:00-15:00 with a smaller movement from 19:00-20:00 (Fig. 4c). Overall trends for the entire season showed peak movement between the hours of 18:00 to 01:00 and 05:00 to 06:00 (Fig. 4d).

Weir and Live Video Counts (non-chinook species)

All other salmonids were enumerated through the weir during the chinook migration period. A total of 14,016 pink, 82 chum, 370 coho, and 26 steelhead were counted through the weir (Table 5). Of the 82 chum, 38 were male and 41 were female with three being unknown. Maximum daily migration of pink past the weir was 2,954 on the 7 August (Figure 5, Table C-1).

Video Review

Video review time varied throughout the season depending primarily on quantity of fish movement and viewing conditions (ie: turbidity). During periods of minimal fish migration, an average of five hours of video were reviewed in one hour and during periods of high migration an average of two hours of video were reviewed in one hour.

The new digital video system allowed observers to review fish movement after migration had occurred instead of conducting real time counts as was performed with the analog video system used in 2001 (Sviatko and Baxter 2002). Allowing observers to replay fish movement and view fish frame per frame increased observer identification and counting efficiency. The observer efficiency in 2002 was therefore assumed to be equal to the results achieved in 2001 at 100% for the chinook enumerations and better than the 95% efficiency achieved for pinks in 2001.

Biosampling – Age and Length

A total of 103 adult chinook were sampled for scales of which 92 were aged successfully (Table 6). Unaged samples include partially aged scales and marine regenerates. Ages ranged from age 4_2 to 6_2 with ages 4_2, 5_2 and 6_2 comprising 9.8%, 75.0%, and 15.2%, of the total aged respectively. Mean lengths of adult males and females were 67.1 cm (n=34, SD= 10.00) and 77.2 cm (n=69, SD= 5.10), respectively. Adult male chinook were widely distributed over the range of 45 to 85 cm with a mode of 64 cm (Figure 6). Female chinook had a mode of 78 cm

with a range of 64 to 87 cm. Adult females sampled in the Nisga'a in-river angling fishery (n=69) were more abundant than males (n=34).

CODED-WIRE TAG RECOVERIES

2001

Commercial and Saltwater Sport Harvests (US and Canada)

Total observed Kincolith River chinook CWT recoveries were 29 and 32 for Canadian and US (Alaska) fisheries, respectively (Table 7). Observed sport recoveries totalled zero for the Canadian fisheries and six for the Alaskan fishery. Coded-wire tag recoveries were from the 1996, 1997, and 1998 brood years. Northern Canadian troll and net catch-to-sample ratios were 2.1 and 3.9, while US troll and net ratios were 1.8 and 3.2, respectively (Table 7). Estimated Kincolith River CWT chinook catches were 108 (63%) and 63 (37%) for Canadian and US fisheries, respectively.

Expanded Canadian and US catches were 683 and 252, respectively, for a total of 935 using the adipose clip ratio at recovery (i.e., escapement method). Estimated total adult return for Kincolith River chinook was 2,160 using the escapement method (Table 8).

Nisga'a FSC Harvests (angling) and Brood Stock Collections

The Nisga'a in-river angling fishery at Kincolith River harvested an estimated 62 CWT chinook in 2001 which were from the 1998 and 1999 releases at Kincolith River (codes 18-32-14, 18-32-15, 18-31-15, 18-31-16, 18-31-17, and 18-31-18). Terminal harvests by Nisga'a anglers accounted for 13.1% of the total CWT returns to Kincolith River in 2001 (Table 7). In addition, a total of 61 chinook were sampled for marks during broodstock collection activities, of which 10 were marked (16.4%; Table A-1). Coded-wire-tagged heads were not taken from broodstock, so no contributions of CWTs could be obtained.

Escapement Past Weir

Crews examined 56 adult chinook at the fence in 2001 for fin clips of which 14 were AFC (Sviatko and Baxter 2002). AFC chinook were comprised of several brood years (1994-1997). The estimated return of chinook to the Kincolith River (1,225) was partitioned into brood years by multiplying the observed age distribution in the escapement by 1,225 and dividing the result by 100. An estimated 306 adipose-clipped adult chinook returned to Kincolith River in 2001.

2002

Commercial and Saltwater Sport Harvests (US and Canada)

Total observed Kincolith River chinook CWT recoveries were 16 and 51 for Canadian and US (Alaska) fisheries respectively (Table 9). Observed sport recoveries totalled two for the Canadian fisheries and 10 for the Alaskan fishery. Coded-wire tag recoveries were from the

1996, 1997, and 1998 brood years. Northern Canadian troll and net catch-to-sample ratios were 3.3 and 4.6, while US troll and net ratios were 2.1 and 2.5, respectively (Table 9). Estimated Kincolith River CWT chinook catches were 90 (45%) and 110 (55%) for Canadian and US fisheries, respectively (Table 9).

Expanded Canadian and US catches were 779 and 817, respectively, for a total of 1,595 using the adipose clip ratio at recovery (i.e., escapement method). Estimated total adult return for Kincolith River chinook was 2,605 using the escapement method (Table 10).

Nisga'a FSC Harvests (angling) and Brood Stock Collections

A total of 46 CWT chinook were estimated to have been harvested in the Nisga'a in-river angling fishery below the fence in 2002 (Table 9), and were from the 1998, 1999 and 2000 releases at Kincolith River (codes 18-32-14, 18-32-15, 18-31-15, 18-31-16, 18-31-17, 18-31-18, 28-01-01, 28-01-02, 28-01-03). Terminal harvests by Nisga'a anglers accounted for approximately 8.1% of the total CWT returns to the Kincolith River in 2002. In addition, a total of 81 chinook were taken for broodstock collection, of which 11 were AFC. Coded-wire tagged heads were not taken from broodstock, so no contributions of CWTs could be obtained.

Escapement Past Weir

Crews examined 982 adult chinook via video review for fin clips of which 171 were AFC (Table 11). AFC chinook were comprised of the 1996-1998 brood years. The estimated return of chinook to the Kincolith River (1,010) was partitioned into brood years by multiplying the observed age distribution in the Nisga'a in-river angling fishery by 1,010 and dividing the result by 100. An estimated 176 adipose-clipped adult chinook returned to Kincolith River in 2002. Smolt to spawner survival (i.e., includes natural and harvest mortality) for hatchery chinook ranged from 0.0% to 0.1% for the 1996 to 1998 brood years. Adipose clip rate at the weir was estimated at 17.4% (Table 11).

EXPLOITATION OF KINCOLITH CHINOOK (BROOD YEAR 1996 - 1998)

Overall harvests of Kincolith hatchery chinook were estimated for the 1996, 1997 and 1998 brood years and consisted of CWT recoveries in the Alaskan and Canadian commercial fisheries, saltwater sport fisheries, test fisheries, brood stock collection, Nisga'a Food fishery, and escapement estimates (Table 12). Coded-wire tag recoveries for the 1999 and 2000 return years were presented in Sviatko and Baxter (2002). A total of 484 CWTs were recovered for the 1996 brood year. Estimated CWT recoveries for the 1997 brood year totalled 386, and included recoveries in 2000, 2001 and 2002, with additional recoveries expected in 2003 (age-6) and 2004 (age-7). A total of 166 CWT recoveries have been received for the 1998 brood year, and include recoveries in 2001 and 2002, with future CWT recoveries expected in 2003, 2004 and 2005.

Exploitation rates on Kincolith River CWT chinook for the 1996 brood year totalled 62.8% (35.6% Canadian and 27.3% US) with terminal harvests by Nisga'a anglers in the Kincolith River accounting for 12.5% (Table 13).

Of the total catch of Kincolith River chinook for brood year 1996, Canadian catch accounted for 56.6% and included 20% terminal harvest by Nisga'a anglers and the US catch accounted for an estimated 43.4% (Table 13).

CWT SURVIVAL OF KINCOLITH CHINOOK (BROOD YEAR 1996)

The preliminary estimate of smolt-to-adult survival for the 1996 brood year is 1.0% (Table 13), and is likely underestimated due to incomplete escapement information for 1999 (age 3) and 2000 (age 4) return years.

DISCUSSION

Video technology has been used to document fish passage and obtain relatively accurate escapement estimates of salmon species in several natural systems (Otis and Dickson 2000, Faurot and Kucera 2001) and at fish counting/viewing windows at hydroelectric projects (Hatch and Schwartzberg 1990, Hatch and Schwartzberg 1991, Hatch et al. 1994a, 1994b). A floating weir in combination with video technology was used at the Kincolith River in 2001 (Sviatko and Baxter 2002), and once again in 2002 in order to obtain accurate escapement estimates of returning salmon species. A total of 1,010 adult chinook were counted through the weir by video monitoring and represents a minimum escapement estimate. An additional 251 chinook were estimated to have been harvested in the Nisga'a angling fishery, which was conducted below the weir (Baxter 2003), and a total of 81 chinook were taken by hatchery staff for broodstock collection (Blair Stewart, pers. comm.). An additional 55 chinook were estimated to have spawned below the fence (Steve Sviatko, pers. comm.). A total of 14,016 pink were estimated to have escaped to the Kincolith River in 2002 based upon video counts. In addition, a total of 70 pink were observed in a side channel below the weir and 500 were observed spawning below the weir (Steve Sviatko, pers. comm.). Minimum escapement estimates for other species included 82 chum, 370 coho and 26 steelhead.

Improvements to the 2001 video system were instituted in 2002 as per recommendations in Sviatko and Baxter 2002. The digital video recorder was a significant improvement over the analog video system used in 2001. The digital system improved playback capabilities allowing for frame by frame viewing of fish species, which in turn led to improved species identification and mark rates of returning chinook. All digital video was archived on hard drives providing a user friendly medium for storage and future reference.

Of the 1,010 adult chinook counted through the weir, 171 were AFC, 811 were non-clipped (adipose present), and 28 were of unknown clip status. This resulted in an observed mark rate of 17.4%. Chinook sampled in the Nisga'a in-river angling fishery had an estimated mark rate of 29.4%, which was based on 92 samples (29 AFC). This mark rate may be biased towards AFC sampled fish due to vulnerability of AFC fish to harvests by Nisga'a anglers as they are thought to be more concentrated in the lower Kincolith River, where the Nisga'a angling fishery occurs. When looking at mark rates of returning chinook, it should be noted that an estimated 54% of chinook released from the Kincolith hatchery for brood years 1996 to 2000 were unclipped. Assuming equal survivals of hatchery and wild fish from the Kincolith River

for these brood years, it is estimated that of the 1,010 chinook that were video counted in 2002, approximately 535 were of hatchery origin.

Very little exploitation and survival information is available for North Coast chinook stocks and the only data that is available comes from the Kitsumkalum chinook indicator stock. McNicol 1999 provides a comprehensive report summarizing all CWT recoveries and escapement information for the Kitsumkalum chinook stock from 1984-1998. Alaskan commercial and sport fisheries have averaged 20.8% harvest rate on Kitsumkalum chinook (53.9% in 1984) for the 1984-1999 catch years. Canadian commercial and sport fisheries have averaged 27.0% harvest rate (46.1% in 1984) for the same period (PSC, 2001, TCCHINOOK (01)-2). Patterns of exploitation for Kitsumkalum chinook indicate that they are harvested in Alaskan waters during the early part of July in outside troll fisheries, and in Canadian waters primarily in northern net and to a lesser extent, northern troll fisheries (McNicol 1999). Preliminary CWT recovery information for Kincolith River chinook indicates similar patterns of exploitation, with the majority of harvests occurring in the troll fisheries in Alaskan waters, and in the northern net fisheries in Canadian waters. Future return years will provide additional information on exploitation and survival rates of Kincolith River chinook.

RECOMMENDATIONS

- Coded-wire tag approximately 75,000 chinook from the 2001 brood year and helicopter release into the upper and middle mainstem of the Kincolith River.
- Continue installing the adult fence and video cameras in the early spring to ensure a complete census of returning chinook.
- Obtain accurate counts of marked and unmarked adult chinook at the weir in order to continue to estimate survival and exploitation of the Kincolith River chinook stock.
- Determine the contribution of hatchery chinook to total stock by monitoring the adult escapement.
- Determine escapements of other species using video counts, especially pink salmon for comparison to DFO helicopter estimates.
- Continue to collect biological data for adult chinook, including scale samples, length (POH), and sex.
- Reinforce the need to collect data on hatchery returns (adipose clips) and age composition from broodstock collection activities and other forms of directed effort (Nisga'a Food Fishery). This data is critical for assessing the survival of hatchery releases and hatchery contribution to total river stock
- Replace weir panels with aluminium ones to improve weir integrity and strength.

- Install a permanent water gauging station that monitors water level and water temperature.

- Conduct velocity measurements on the Kincolith River in order to establish flow regimes and discharge.

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TABLES

Table 1. Numbers of chinook, coho, and chum salmon reared and released from the Kincolith Hatchery, 1979-2001 brood years.

Brood year	Eggs taken	Fry Rearing		Pre-smolts released			Smolts released [a]			% survival of			% marked fish released	Average rel. weight (g)
		Troughs	Ponds	AFC	Unclipped	Total	AFC	Unclipped	Total	Egg-fry	Fry-smolt	Egg-smolt		
Chinook														
1980	6,000	4,300	300	-	4,000	4,000	-	-	-	72	0	0.0	0.0	1.5
1981	42,720	14,952	14,952	-	-	-	-	-	-	35	0	0.0	0.0	NA
1982														
1983	85,313	15,700	473	-	15,227	15,227	-	-	-	18	0	0.0	0.0	2.4
1984	61,107	40,483	1,547	-	38,936	38,936	-	-	-	66	0	0.0	0.0	1.0
1985	161,486	149,233	5,081	-	144,152	144,152	-	750	750	92	15	4.3	0.0	1.8
1986	135,514	95,847	95,847	-	-	-	33,082	23	33,105	71	35	24.4	99.9	13.2
1987	102,763	73,945	73,945	-	-	-	45,451	6,855	52,306	72	71	50.9	86.9	17.0
1988	95,110	75,091	75,091	-	-	-	70,678	236	70,914	79	94	74.6	99.7	19.0
1989	123,445	113,774	113,774	-	-	-	48,100	49,929	98,029	92	86	79.4	49.1	15.0
1990	202,115	195,666	195,666	-	-	-	18,632	41,470	60,102	97	31	29.7	31.0	10.0
1991	202,754	192,663	2,663	176,100	13,900	190,000	-	-	-	95	0	0.0	92.7	5.0
1992	222,972	199,844	199,844	-	-	-	49,042	145,918	194,960	90	98	87.4	25.2	18.0
1993	316,989	254,527	254,527	-	-	-	-	176,731	176,731	80	69	55.8	0.0	14.0
1994	152,726	89,876	89,876	-	-	-	6,841	2,197	9,038	59	10	5.9	75.7	7.0
1995	170,252	144,387	144,387	-	-	-	10,000	-	10,000	85	7	5.9	100.0	7.0
1996	279,552	273,890	110,384	-	163,506	163,506	50,871	43,926	94,797	98	86	81.7	19.7	12.0
1997	254,960	219,815	219,815	-	-	-	93,202	62,189	155,391	86	71	60.9	60.0	10.0
1998	157,703	141,899	134,304	-	-	-	52,864 [b]	54,384	107,248	90	80	68.0	49.3	4.4
1999	200,383	171,738	151,549	-	-	-	-	146,258	146,258	86	97	73.0	0.0	7.5
2000	89,271	79,026	74,791				71,741	3,050	74,791	89	100	83.8	95.9	
2001	228,799	192,253	186,835							84	0			
Totals:														
1980's	**813,458**	**583,325**	**381,010**	**-**	**202,315**	**202,315**	**197,311**	**57,793**	**255,104**	**71.7**	**67.0**	**41.7**	**43.1**	**8.9**
1990's	**2,160,406**	**1,884,305**	**1,503,015**	**176,100**	**177,406**	**353,506**	**281,452**	**673,073**	**954,525**	**87.2**	**63.5**	**52.8**	**35.0**	**9.5**
2000's	**318,070**	**271,279**	**261,626**				**71,741**	**3,050**	**74,791**	**85.3**	**28.6**	**23.5**	**95.9**	**9.4**
1996-00	**1,210,668**	**1,078,621**	**877,678**	**-**	**163,506**	**163,506**	**268,678**	**309,807**	**578,485**	**89.1**	**65.9**	**55.2**	**36.2**	**9.4**

Table 1. Numbers of chinook, coho, and chum salmon reared and released from the Kincolith Hatchery, 1979-2001 brood years.

Brood year	Eggs taken	Fry Rearing		Pre-smolts released			Smolts released [a]			% survival of			% marked fish released	Average rel. weight (g)
		Troughs	Ponds	AFC	Unclipped	Total	AFC	Unclipped	Total	Egg-fry	Fry-smolt	Egg-smolt		
Coho														
1979	40,000	1,000		-	980	980	-	-	-	3	0	0.0	0.0	2.2
1980	46,000	-		-	-	-	-	-	-	0	0	0.0	0.0	NA
1981	98,424	-		-	-	-	-	-	-	0	0	0.0	0.0	NA
1982	129,540	122,000		-	118,000	118,000	-	-	-	94	0	0.0	0.0	3.0
1983	150,637	141,047		-	-	-	26,667	78,333	105,000	94	74	69.7	25.4	6.0
1984	129,285	103,632		-	-	-	46,508	17,974	64,482	80	62	49.9	72.1	12.0
1985	182,312	173,196		51,466	62,415	113,881	4,270	-	4,270	95	2	6.2	47.2	5.0
1986	120,503	109,107		-	-	-	33,085	244	33,329	91	31	27.7	99.3	11.9
1987	204,789	190,000		3,000	-	3,000	-	-	-	93	0	0.0	100.0	2.0
1988	100,935	96,527		-	-	-	33,332	41,396	74,728	96	77	74.0	44.6	NA
1989	157,300	20,491		-	15,000	15,000	-	-	-	13	0	0.0	0.0	NA
1990	103,362	90,000		16,450	13,550	30,000	-	-	-	87	0	0.0	54.8	NA
1991	243,656	185,861		-	-	-	29,784	152,216	182,000	76	98	74.7	16.4	NA
1992	106,837	65,309		-	-	-	36,395	22,958	59,353	61	91	55.6	61.3	12.0
1993	36,382	32,261		-	-	-	20,125	5,670	25,795	89	80	70.9	78.0	15.0
1994	100,000	81,062		-	-	-	8,069	8,143	16,212	81	20	16.2	49.8	7.0
1995	129,386	123,431		-	-	-	38,905	59,480	98,385	95	80	76.0	39.5	6.6
1996	108,875	96,246		-	-	-	-	60,474	60,474	88	63	55.5	0.0	12.0
Total	**2,188,223**	**1,631,170**		**70,916**	**209,945**	**280,861**	**277,140**	**446,888**	**724,028**	**74.5**	**44.4**	**38.0**	**34.6**	**7.7**
Chum														
1991 [c]	35,000	5,000		-	5,000	5,000	-	-	-	14	100		0.0	NA
1994 [c]	239,882	160,000		-	160,000	160,000	-	-	-	67	100		0.0	<1.0
1995	170,471	10,000		-	10,000	10,000	-	-	-	6	100		0.0	<1.0
1996	19,942	18,739		-	5,282	5,282	-	-	-	94	28		0.0	<1.0
1997	2,602	2,482		-	2,000	2,000	-	-	-	95	81		0.0	2.0
1998	15,198	14,927		-	3,905	3,905	-	-	-	98	26		0.0	<1.0
Total	**467,897**	**196,221**		**-**	**182,282**	**182,282**	**-**	**-**	**-**	**41.9**	**92.9**	**0.0**	**0.0**	**<1.0-2.0**

[a] ADF=adipose fin clips from CWT, includes CWT losses.

[b] 61056 adipose fin clipped but 8192 lost due to pilot error; total AFC released is 52916

[c] Broodstock taken from Stagoo Creek.

Table 2. Kincolith River chinook age structure, by sex and return year.

Males	Return Year									
	1996 [a]		1998 [b]		2001 [c]		2002 [d]		Average of years	
Total age	N	%	N	%	N	%	N	%	N	%
3	4	4.9	0	0	0	0.0	0	0.0	4	2.3
4	20	24.7	1	2.5	8	34.8	8	29.6	37	21.6
5	41	50.6	33	82.5	12	52.2	16	59.3	102	59.6
6	16	19.8	6	15.0	3	13.0	3	11.1	28	16.4
7	0	0	0	0	0	0.0	0	0.0	0	0.0
Total sample size	81		40		23		27		171	

Females	Return Year									
	1996 [a]		1998 [b]		2001 [c]		2002 [d]		Average of years	
Total age	N	%	N	%	N	%	N	%	N	%
3	0	0	0	0.0	0	0.0	0	0.0	0	0.0
4	1	1.4	0	0.0	3	9.1	1	1.7	5	2.5
5	56	76.7	19	52.8	23	69.7	48	80.0	146	72.3
6	16	21.9	17	47.2	5	15.2	11	18.3	49	24.3
7	0	0	0	0.0	2	6.1	0	0.0	2	1.0
Total sample size	73		36		33		60		202	

Combined (male and female)	Return Year									
	1996 [a]		1998 [b]		2001 [c]		2002 [d]		Average of years	
Total age	N	%	N	%	N	%	N	%	N	%
3	4	2.6	0	0.0	0	0.0	0	0.0	4	1.1
4	21	13.6	1	1.3	11	19.6	9	10.3	42	11.3
5	97	63.0	52	68.4	35	62.5	64	73.6	248	66.5
6	32	20.8	23	30.3	8	14.3	14	16.1	77	20.6
7	0	0.0	0	0.0	2	3.6	0	0.0	2	0.5
Total sample size	154		76		56		87		373	

a Stephens, C.Y., B. L. Nass and R. F. Alexander 1998. The Kincolith River enhancement program for chinook, coho and chum salmon, 1996-97. Results from the rearing of 1996 brood and release of 1995 brood. Report prepared by Nisga'a Tribal Council, New Aiyansh, B.C

[b] Stephens, C.Y. And R. F. Alexander 1999. The Kincolith River enhancement program for chinook, coho and chum salmon, 1998-99. Results from the rearing of 1998 brood and release of 1997 brood. Report prepared by Nisga'a Tribal Council, New Aiyansh, B.C

[c] Sviatko, S. and B. E. Baxter 2002. Adult chinook salmon enumeration and coded-wire tag recovery analysis for Kincolith River, BC, 2001. Report NF 01-12 prepared by LGL Limited, Sidney, BC, for the Nisga'a Lisims Government, New Aiyansh, BC.

[d] This report, does not include chinook that were aged but not sexed.

Table 3. Summary of tag codes used at Kincolith hatchery, Brood Years 1996-2000.

			Smolts released			
Brood Year	Release Year	Tag Code	Total AFC only	Total CWT	unmarked	Grand Total
1996	1998	18-32-14	73	22,844	19,788	42,705
1996	1998	18-32-15	179	27,775	24,138	52,092
		Totals	252	50,619	43,926	94,797
1997	1999	18-31-15	356	21,899	14,756	37,011
1997	1999	18-31-16	450	24,565	16,552	41,567
1997	1999	18-31-17	100	24,892	16,772	41,764
1997	1999	18-31-18	0	20,940	14,109	35,049
		Totals	906	92,296	62,189	155,391
1998	2000	28-01-01	7	23,993	24,686	48,686
1998	2000	28-01-02	0	12,520	12,882	25,402
1998	2000	28-01-03	0	16,344	16,816	33,160
		Totals	7	52,857	54,384	107,248
1999 [a]	2001		0	0	146,258	146,258
		Totals	0	0	146,258	146,258
2000	2002	18-31-33	266	30,400	1,585	32,251
	2002	18-31-34	116	27,440	1,101	28,657
	2002	18-34-50	52	13,342	364	13,758
		Totals	434	71,182	3,050	74,666
Grand Totals			**1,599**	**266,954**	**309,807**	**578,360**

[a] No coded-wire tagging took place in 1999.

Table 4. Chinook adult counts at Kincolith River enumeration fence, by week, 2002.

Week ending	Chinook Count
8-Jun	6
15-Jun	20
22-Jun	21
29-Jun	53
6-Jul	127
13-Jul	133
20-Jul	98
27-Jul	159
3-Aug	131
10-Aug	121
17-Aug	108
22-Aug	33
Total	1,010

Table 5. Non-chinook adult counts at Kincolith River enumeration fence, by week, 2002.

Week ending	Pink[a]	Chum[b]	Coho[b]	Steelhead[b]
8-Jun	0	0	0	5
15-Jun	0	0	0	3
22-Jun	0	0	0	3
29-Jun	0	1	0	3
6-Jul	0	1	0	5
13-Jul	10	0	0	5
20-Jul	9	0	0	1
27-Jul	442	11	0	1
3-Aug	706	4	18	0
10-Aug	7,311	8	41	0
17-Aug	2,527	27	126	0
22-Aug	3,011	30	185	0
Total	14,016	82	370	26

[a] Represents complete count throughout entire escapement.

[b] Only covers a portion of the escapement and represents a minimum estimate.

Table 6. Total age distribution of adult chinook at Kincolith River enumeration fence, 2002.

Sex	Age 4		Age 5		Age 6		Total aged	Total unaged	Total sampled
	No.	%	No.	%	No.	%			
Adult males	8	29.6	16	59.3	3	11.1	27	7	34
Adult females	1	1.7	48	80.0	11	18.3	60	9	69
Not Sexed	0	0.0	5	100.0	0	0.0	5	2	7
Total adults	9	9.8	69	75.0	14	15.2	92	18	103

Table 7. Estimated Canadian and American harvests of Kincolith River CWT chinook in 2001 using tag recovery data (Mark Recovery Program, Fisheries and Oceans, Canada and ADF&G mark tag and age lab, online searchable database).

Tag			Observed CWT catch [a]					Catch-sample ratio [b]				Estimated CWT catch [c]				
code	BY	Age	N. Troll	N. Net	Sport	In-river Angling	Total	N. Troll	N. Net	Sport	In-river Angling	N. Troll	N. Net	Sport	In-river Angling	Tota
Canadian																
18-32-14	1996	5	1	7	0	18	26	1.0	3.6	0.0	1.4	1	25	0	25	
18-32-15	1996	5	1	7	0	18	26	3.2	4.2	0.0	1.4	3	30	0	25	
18-31-15	1997	4	0	4	0	2	6	0.0	4.2	0.0	1.4	0	17	0	3	
18-31-16	1997	4	0	4	0	1	5	0.0	3.7	0.0	1.4	0	15	0	1	
18-31-17	1997	4	0	2	0	4	6	0.0	5.0	0.0	1.4	0	10	0	6	
18-31-18	1997	4	0	2	0	1	3	0.0	3.4	0.0	1.4	0	7	0	1	
28-01-01	1998	3	0	0	0	0	0	0.0	0.0	0.0	0.0	0	0	0	0	
28-01-02	1998	3	0	0	0	0	0	0.0	0.0	0.0	0.0	0	0	0	0	
28-01-03	1998	3	0	1	0	0	1	0.0	1.8	0.0	0.0	0	2	0	0	
Total			2	27	0	44	73	2.1	3.9	0.0	1.4	4	104	0	62	1
American																
18-32-14	1996	5	9	0	3	-	12	1.8	0.0	2.4	-	16	0	7	-	
18-32-15	1996	5	4	0	1	-	5	1.9	0.0	1.0	-	8	0	1	-	
18-31-15	1997	4	3	1	2	-	6	2.0	3.2	2.4	-	6	3	5	-	
18-31-16	1997	4	1	1	0	-	2	1.3	3.2	0.0	-	1	3	0	-	
18-31-17	1997	4	3	0	0	-	3	2.2	0.0	0.0	-	7	0	0	-	
18-31-18	1997	4	4	0	0	-	4	1.4	0.0	0.0	-	6	0	0	-	
28-01-01	1998	3	0	0	0	-	0	0.0	0.0	0.0	-	0	0	0	-	
28-01-02	1998	3	0	0	0	-	0	0.0	0.0	0.0	-	0	0	0	-	
28-01-03	1998	3	0	0	0	-	0	0.0	0.0	0.0	-	0	0	0	-	
Total			24	2	6	-	32	1.8	3.2	2.2	-	44	6	13	-	
Total			26	29	6	44	105	1.8	3.8	2.2	1.4	48	111	13	62	2
												Total commercial				1
												Total sport				
												Total native in-river angling fishery [d]				
												Total escapement [e]				2
												Total CWT				4

[a] Observed CWT = CWT's recovered from the commercial and sport catch.

[b] Cumulative catch-sample ratio = total chinook catch / total chinook sampled.

[c] Estimated CWT = observed CWT catch * catch sampling ratio.

[d] estimated harvest.

[e] Estimated CWT's (adipose clips corrected for tag loss at return); see Sviatko and Baxter 2002.

Table 8. Expanded Canadian and American harvests of Kincolith River chinook and estimated total return, from CWT data in 2001.

Tag code	Age	Total release	Smolts tagged [a]	Mark rate [b]	Expanded catch [c] Canadian Troll	Net	Sport	Inriver Angling	Total	American Troll	Net	Sport	Total	Grand Total	Contribution escap.	Total return [d]
18-32-14	5	42,705	22,844	1.869	2	47	0	48	96	31	0	14	44	141		
18-32-15	5	52,092	27,775	1.875	6	55	0	48	109	14	0	2	16	125		
														266	286	552
18-31-15	4	37,011	21,899	1.690	0	28	0	5	33	10	5	8	24	57		
18-31-16	4	41,567	24,565	1.692	0	25	0	2	27	2	5	0	8	35		
18-31-17	4	41,764	24,892	1.678	0	17	0	9	26	11	0	0	11	37		
18-31-18	4	35,049	20,940	1.674	0	11	0	2	14	9	0	0	9	23		
														152	146	298
28-01-01	3	48,686	23,993	2.029	0	0	0	0	0	0	0	0	0	0		
28-01-02	3	25,402	12,520	2.029	0	0	0	0	0	0	0	0	0	0		
28-01-03	3	33,160	16,344	2.029	0	4	0	0	4	0	0	0	0	4		
														4	0	4
Total 2 [e]				4.00	17	418	0	249	683	174	26	53	252	935	1,225	2,160

[a] Number smolts released with tags (corrected for tag loss), Stephens and Alexander 1999.

[b] Mark rate at release (= No. released / No. marked) for smolts and Total 1 (MRP method), and mark rate at return for total 2 (Escapement method).

[c] Expanded catch = EST * mark rate at release.

[d] Total return = expanded catch + escapement.

[e] Total 2 expanded catch is calculated using the total adipose clip rate at recovery and the total estimated catch for all tag codes (See Sviatko and Baxter 2002, Table 12).

Table 9. Estimated Canadian and American harvests of Kincolith River CWT chinook in 2002 using tag recovery data (Mark Recovery Program, Fisheries and Oceans, Canada and ADF&G mark tag and age lab, online searchable database).

Tag			Observed CWT catch [a]						Catch-sample ratio [b]					Estimated CWT catch [c]					
code	BY	Age	N. Troll	N. Net	Sport	Test	In-river Angling	Total	N. Troll	N. Net	Sport	Test	In-river Angling	N. Troll	N. Net	Sport	Test	In-river Angling	Total
Canadian																			
18-32-14	1996	6	1	1	0	0	1	3	4.1	2.3	0.0	0.0	1.2	4	2	0	0	1	
18-32-15	1996	6	0	1	0	0	4	5	0.0	3.8	0.0	0.0	1.2	0	4	0	0	5	
18-31-15	1997	5	0	1	0	0	15	16	0.0	3.9	0.0	0.0	1.2	0	4	0	0	18	2
18-31-16	1997	5	1	0	0	0	5	6	4.1	0.0	0.0	0.0	1.2	4	0	0	0	6	
18-31-17	1997	5	0	1	0	0	6	7	0.0	4.7	0.0	0.0	1.2	0	5	0	0	7	1
18-31-18	1997	5	0	2	0	0	4	6	0.0	1.9	0.0	0.0	1.2	0	4	0	0	5	
28-01-01	1998	4	2	1	0	0	2	5	2.5	16.8	0.0	0.0	1.2	5	17	0	0	2	2
28-01-02	1998	4	0	1	0	0	2	3	0.0	4.2	0.0	0.0	1.2	0	4	0	0	2	
28-01-03	1998	4	0	2	2	0	0	4	0.0	3.0	15.7	0.0	0.0	0	6	31	0	0	
Total			4	10	2	0	39	55	3.3	4.6	15.7	0.0	1.2	13	46	31	0	46	1
American																			
18-32-14	1996	6	1	0	1	0	-	2	1.6	0.0	6.5	0.0	-	2	0	6	0	-	
18-32-15	1996	6	2	0	0	0	-	2	2.0	0.0	0.0	0.0	-	4	0	0	0	-	
18-31-15	1997	5	1	0	1	0	-	2	3.0	0.0	0.0	0.0	-	3	0	0	0	-	
18-31-16	1997	5	1	0	1	0	-	2	2.9	0.0	1.0	0.0	-	3	0	1	0	-	
18-31-17	1997	5	3	0	2	0	-	5	2.6	0.0	0.6	0.0	-	8	0	1	0	-	
18-31-18	1997	5	2	0	0	0	-	2	2.2	0.0	0.0	0.0	-	4	0	0	0	-	
28-01-01	1998	4	7	1	3	1	-	12	1.6	2.2	2.3	1.0	-	11	2	7	1	-	1
28-01-02	1998	4	12	1	2	0	-	15	1.9	2.5	5.3	0.0	-	23	2	11	0	-	3
28-01-03	1998	4	8	1	0	0	-	9	2.3	2.9	0.0	0.0	-	18	3	0	0	-	2
Total			37	3	10	1	-	51	2.1	2.5	2.6	0.0	-	76	8	26	1	-	1
Total			41	13	12	1	39	106	2.2	4.1	4.8	0.0	1.2	89	53	58	1	46	2
														Total commercial					1
														Total sport					
														Total Test					
														Total native in-river angling fishery [d]					
														Total escapement [e]					1
														Total CWT					4

[a] Observed CWT = CWT's recovered from the commercial and sport catch.

[b] Cumulative catch-sample ratio = total chinook catch / total chinook sampled.

[c] Estimated CWT = observed CWT catch * catch sampling ratio.

[d] estimated harvest.

[e] Estimated CWT's (adipose clips corrected for tag loss at return);see table 11 (Brood Years 1996-1998).

Expanded Canadian and American harvests of Kincolith River chinook and estimated total return, from CWT data in 2002.

Age	Total release	Smolts tagged [a]	Mark rate [b]	Expanded catch [c] Canadian Troll	Net	Sport	Inriver Angling	Total	American Troll	Net	Sport	Test	Total	Grand Total	Contribution escap.	Total return [d]
6	42,705	22,844	1.869	8	4	0	2	14	3	0	12	0	15	29		
6	52,092	27,775	1.875	0	7	0	9	16	7	0	0	0	7	23		
														53	50	102
5	37,011	21,899	1.690	0	7	0	30	36	5	0	0	0	5	41		
5	41,567	24,565	1.692	7	0	0	10	17	5	0	2	0	7	23		
5	41,764	24,892	1.678	0	8	0	12	20	13	0	2	0	15	35		
5	35,049	20,940	1.674	0	6	0	8	14	7	0	0	0	7	22		
														121	221	342
4	48,686	23,993	2.029	10	34	0	5	49	23	4	14	2	44	93		
4	25,402	12,520	2.029	0	8	0	5	13	46	5	22	0	73	86		
4	33,160	16,344	2.029	0	12	64	0	76	37	6	0	0	43	119		
														298	35	333
			5.74	76	262	180	261	779	437	43	330	6	817	1,595	1,010	2,605

nolts released with tags (corrected for tag loss), Stephens and Alexander 1999.

at release (= No. released / No. marked) for smolts and Total 1 (MRP method), and mark rate at return for total 2 (Escapement method).

catch = EST * mark rate at release.

n = expanded catch + escapement.

panded catch is calculated using the total adipose clip rate at recovery and the total estimated catch for all tag codes (Table 9).

Table 11. Estimates of total escapement of adipose clipped chinook and contribution to escapement at Kincolith River, 2002.

Return Year	Brood Year	Age	No. examined (A)	% Age	No. with adipose clips (B)	% AFC (C=B/Ax100)	Population estimate (D)	% sampled (E=A/Dx100)	Estimated adipose clips (F=B/AxD)	No. smolts [a] AFC	No. smolts [a] unclipped	No. smolts [a] % AFC	Contribution to escap. [b]	Smolt to spawner (%) [c]
2002	1998	4	98	10	17	17.4	99	99.2	17	52,857	54,384	49.3	35	0.0
2002	1997	5	737	75	128	17.4	758	97.2	132	92,296	62,189	59.7	221	0.1
2002	1996	6	147	15	26	17.4	154	95.9	27	50,619	43,926	53.5	50	0.1
Total			982	100	171	17.4	1,010	97.5	176	65,257	53,500	54	306	0.1

[a] smolt releases of the previous migration years; an unknown number of additional unclipped releases were likely.

[b] marked contribution to escapement = estimated adipose clips passing weir * age composition in escapement.

[c] % survival = estimated AFC + AFC below the fence / AFC smolts* 100.

Table 12. Summary of observed and estimated CWT recoveries for Kincolith hatchery by brood year, 1996-1998.

Brood Year[a]	Recovery Years	Observed CWT recoveries (Commercial fisheries)[b]				Observed CWT Sport Recoveries[c]				Observed CWT Test Fishery Recoveries[d]				Observed Food Fish Harvest[e]				Observed CWT Escapement				Grand Total
		Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	
Canadian																						
1996	1999-2003	6	7	16	3	4	1	0	0	0	0		0	4	0	36	5	-	-	7	26	115
1997	2000-2004	2	12	5	-	0	0	0	-	0		0		0	8	30	-	-	4	128	-	189
1998	2001-2005	1	6	-	-	0	2	-	-		0			0	5	-	-	0	17	-	-	31
American																						
1996	1999-2003	0	22	13	3	0	5	4	1	1	2		0	-	-	-	-	-	-	-	-	51
1997	2000-2004	1	13	7	-	0	2	4	-	0		0	-	-	-	-	-	-	-	-	-	27
1998	2001-2005	0	30	-	-	0	5	-	-		1	-	-	-	-	-	-	-	-	-	-	36
Grand Totals		10	90	41	6	4	15	8	1	1	3	0	-	4	13	66	5	0	21	135	26	449

Brood Year[a]	Recovery Years	Estimated CWT recoveries (Commercial fisheries)[b]				Estimated CWT Sport Recoveries[c]				Estimated CWT Test Fishery Recoveries[d]				Estimated Food Fish Harvest[e]				Estimated CWT Escapement				Grand Total
		Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	
Canadian																						
1996	1999-2003	9	16	59	10	10	7	0	0	0	0		0	4	0	51	6	-	-	153	27	352
1997	2000-2004	5	48	16	-	0	0	0	-	0		0		0	11	35	-	-	88	132	-	335
1998	2001-2005	2	32	-	-	0	31	-	-		0			0	5	-	-	0	17	-	-	87
American																						
1996	1999-2003	0	45	24	6	0	39	8	6	1	2		0	-	-	-	-	-	-	-	-	132
1997	2000-2004	0.4	26	18	-	0	5	2	-	0		0	-	-	-	-	-	-	-	-	-	51
1998	2001-2005	0	60	-	-	0	18	-	-		1	-	-	-	-	-	-	-	-	-	-	79
Grand Totals		16	227	117	16	10	100	10	6	1	3	0	-	4	16	86	6	0	105	285	27	1,036

[a] Brood year recoveries incomplete; see Sviatko and Baxter 2002 for 1999 and 2000 CWT recovery data.

[b] Includes commercial CWT recoveries in the Alaskan and Canadian Fisheries.

[c] Includes sport CWT recoveries in Alaskan and Canadian Fisheries.

[d] Includes Test fishery CWT recoveries.

[e] Includes CWT recoveries in the Nisga'a Food Fishery, broodstock collection.

Table 13. Kincolith chinook exploitation and smolt-adult survival, by brood year, at Kincolith River, 1998-2002.

Smolt Out-migration[a]				Estimated CWT Recoveries	% Esc	% Canadian Exploitation			% US Exploitation	Combined Exploitation Rate	% Can. Catch			% US Catch	Smolt-adult Surv. (%)	
BY	Count	Estimate	CWT			Commercial, Sport	In-river Angling	Total % Can. Exploitation	Commercial, Sport, Test	%Can + US	Commercial, Sport	In-river Angling	Total % Can. Catch	Commercial	Estimated CWT	C-B
		A	B	C												
1996	94,797	94,797	50,619	484	37.2	23.0	12.5	35.6	27.3	62.8	36.6	20.0	56.6	43.4	1.0	
1997	155,391	155,391	92,296	386	-	-	-	-	-	-	-	-	-	-	-	
1998	107,248	107,248	52,857	166	-	-	-	-	-	-	-	-	-	-	-	
1999[b]	146,258	146,258	-	-	-	-	-	-	-	-	-	-	-	-	-	
2000	74,666	71,656	71,182	-	-	-	-	-	-	-	-	-	-	-	-	
Average	115,672	115,070	66,739	345	37.2	23.0			27.3	62.8	36.6			43.4	1.0	

Estimate A = Best estimate of total smolt release.
CWT B = Number of smolts that were Coded-wire tagged.
Estimate C = Expanded catch using total adipose clip rate at recovery and the total estimated catch for all tag codes.
CWT C= Estimated catch and escapement of Kincolith River CWT chinook by tag code, including commercial, sport, native, broodstock recoveries.

[a] Includes just hatchery released fish

[b] No Coded-wire-tagging took place in 2001.

FIGURES

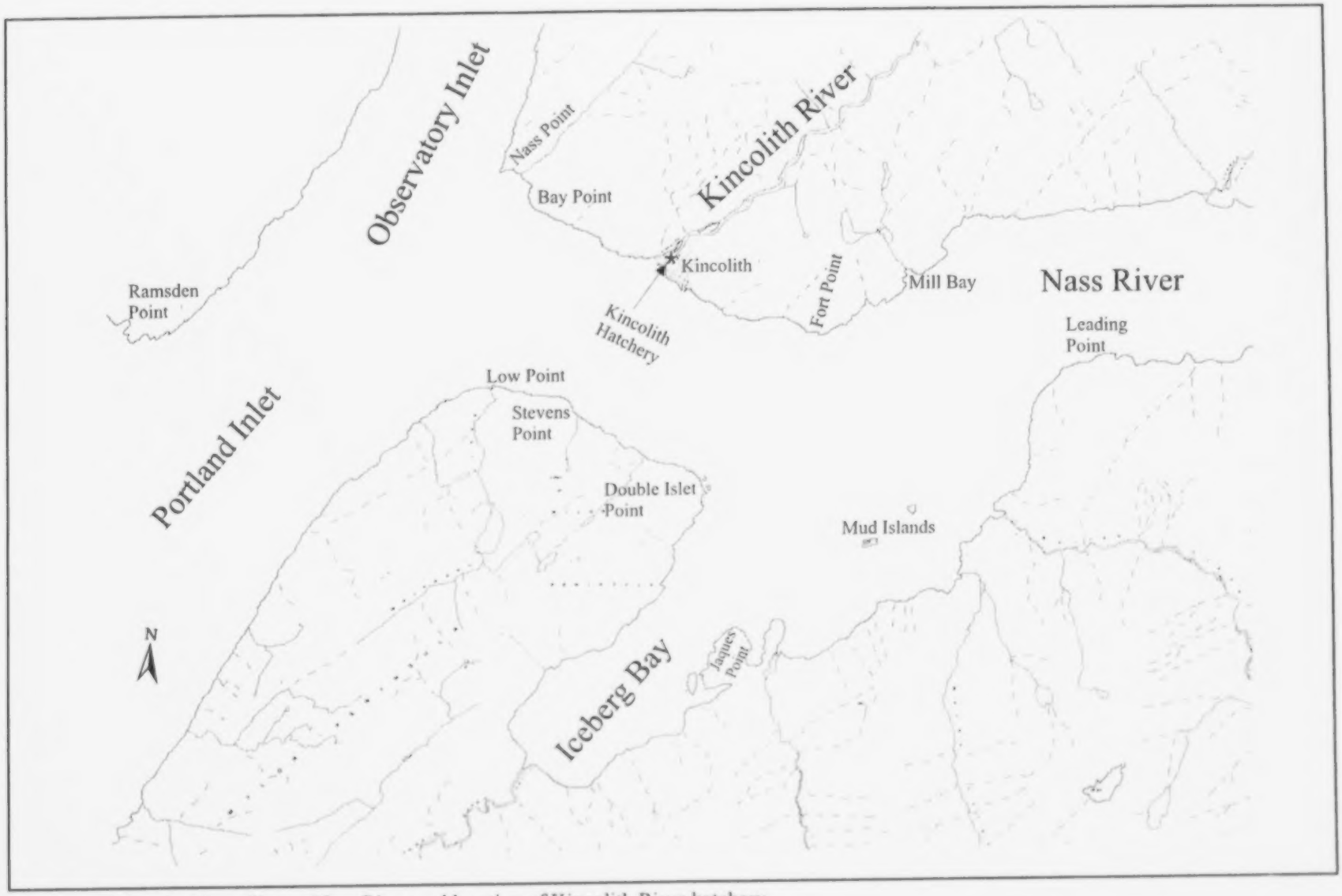


Figure 1. Map of lower Nass River and location of Kincolith River hatchery.

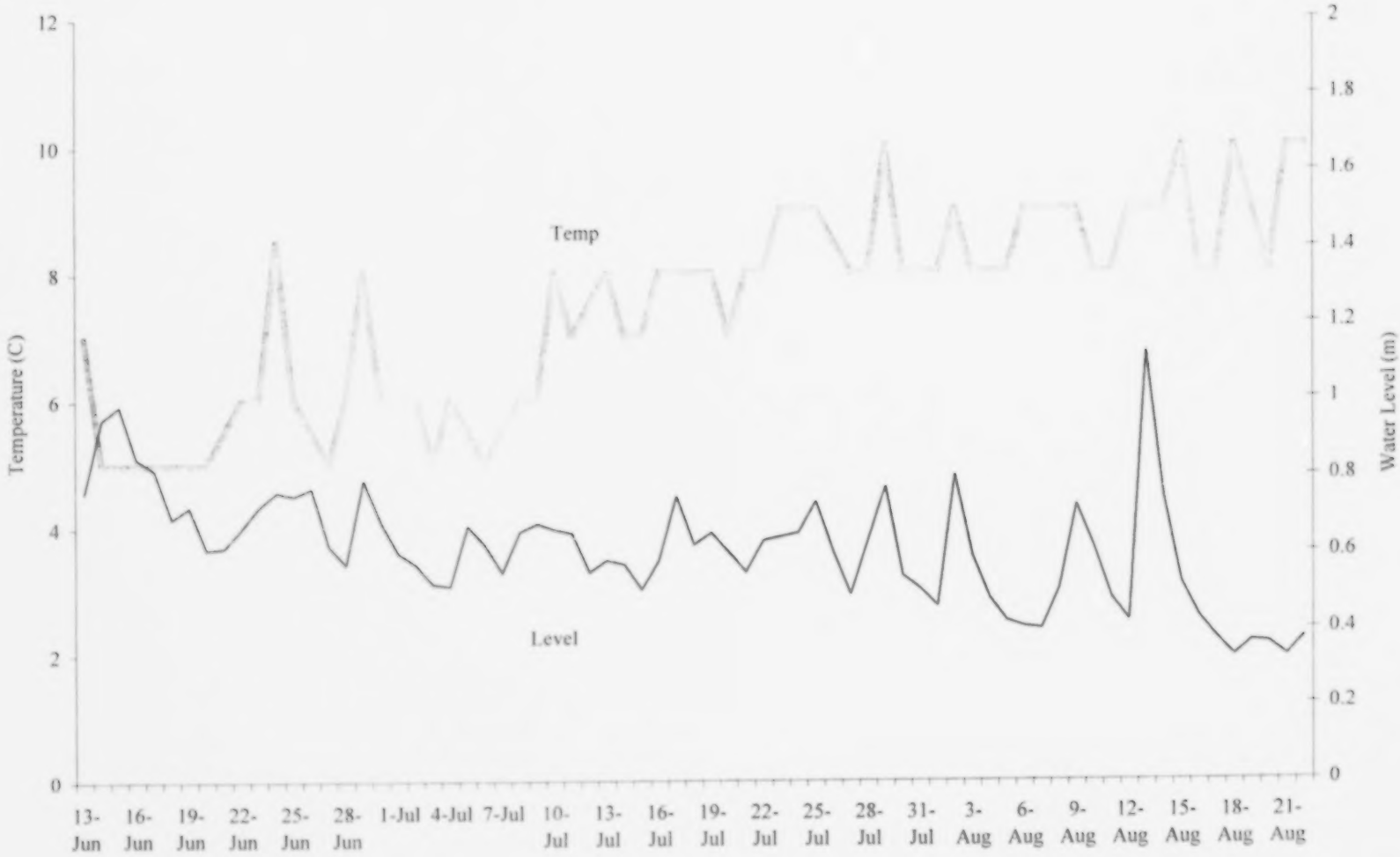


Figure 2. Water level and temperature at Kincolith River, 2002.

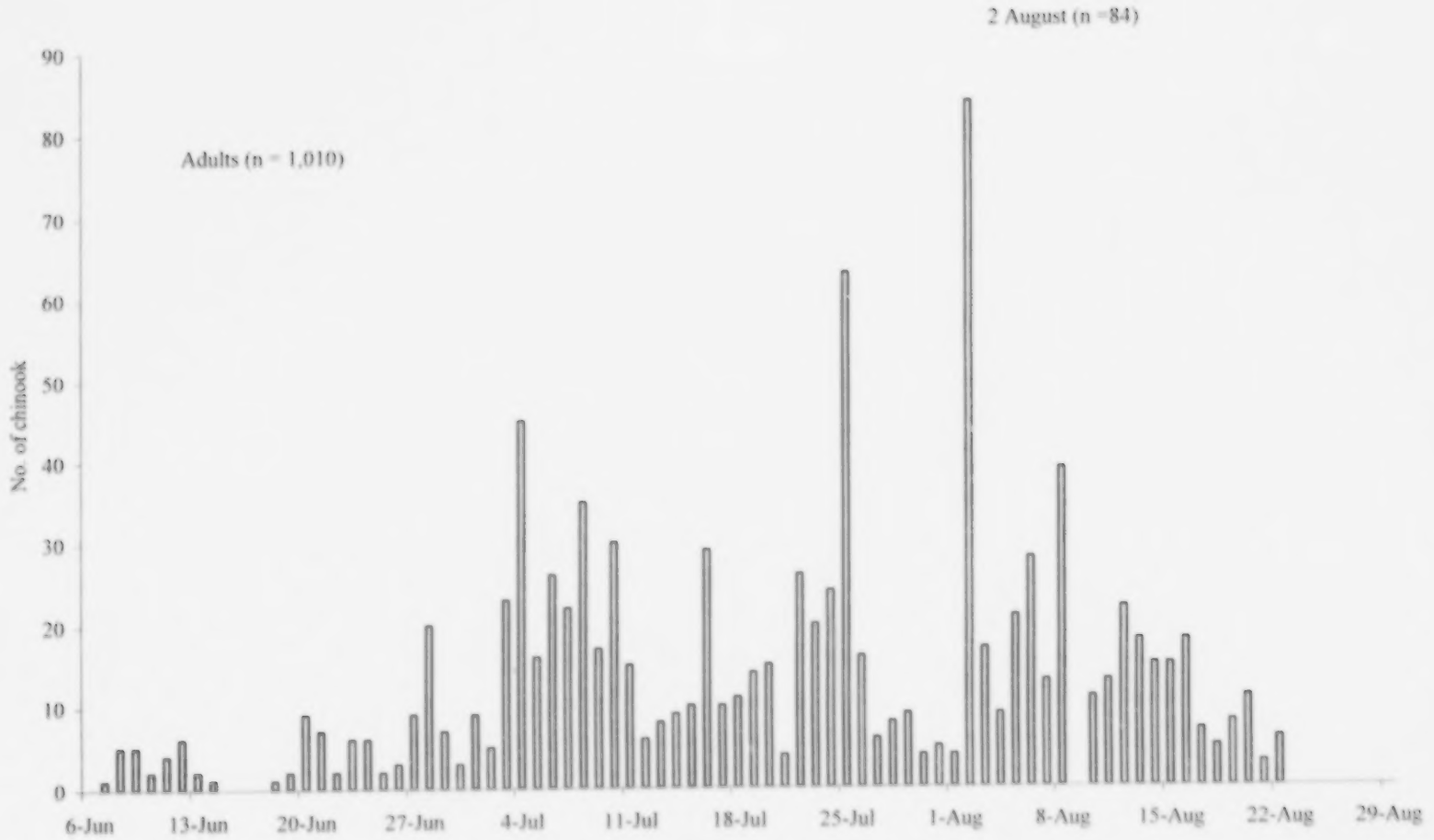


Figure 3. Daily counts of adult chinook at the Kincolith River enumeration weir, 6 June - 22 August, 2002

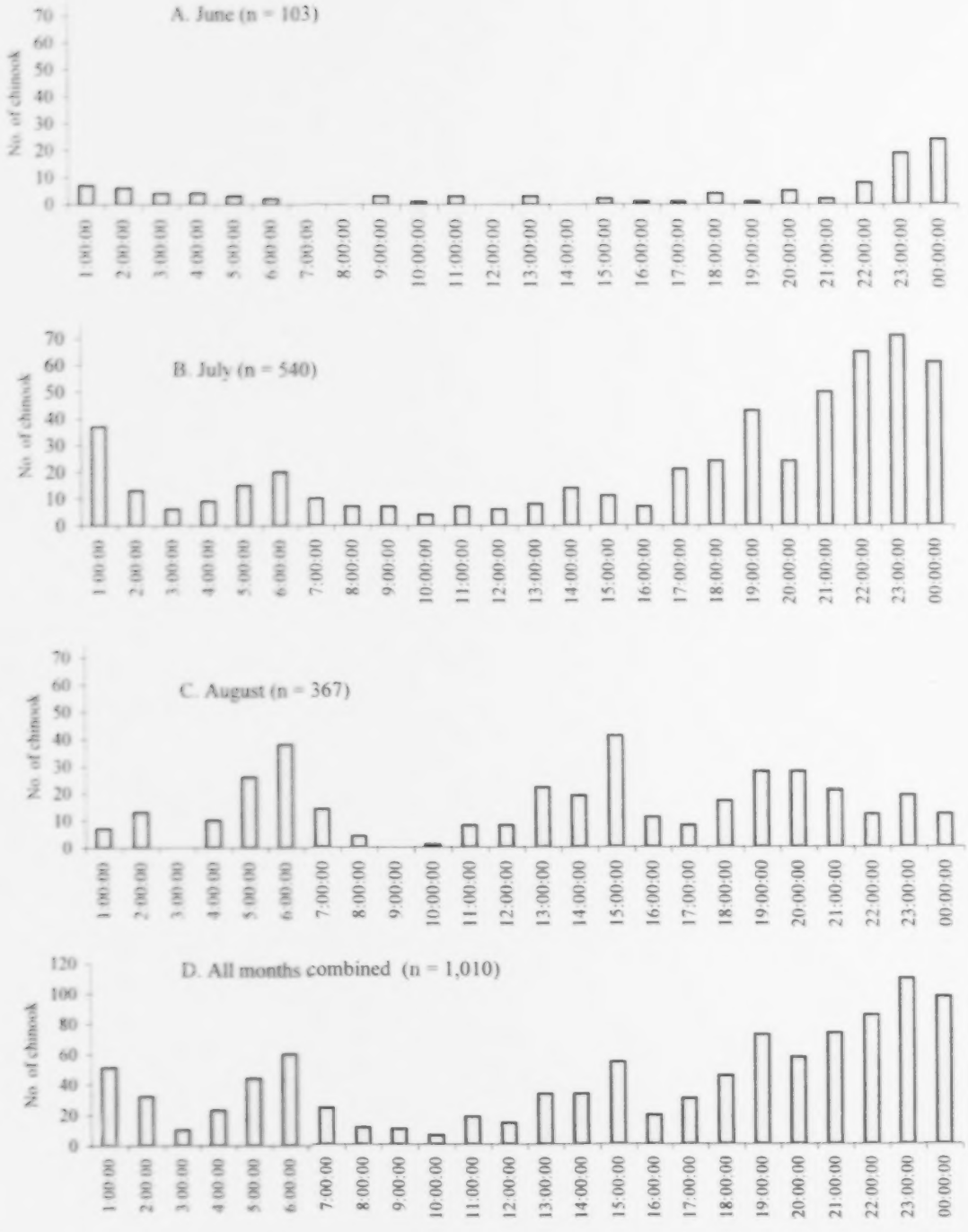


Figure 4. Chinook migration through Kincolith weir by hourly intervals, 6 June - 22 August, 2002.

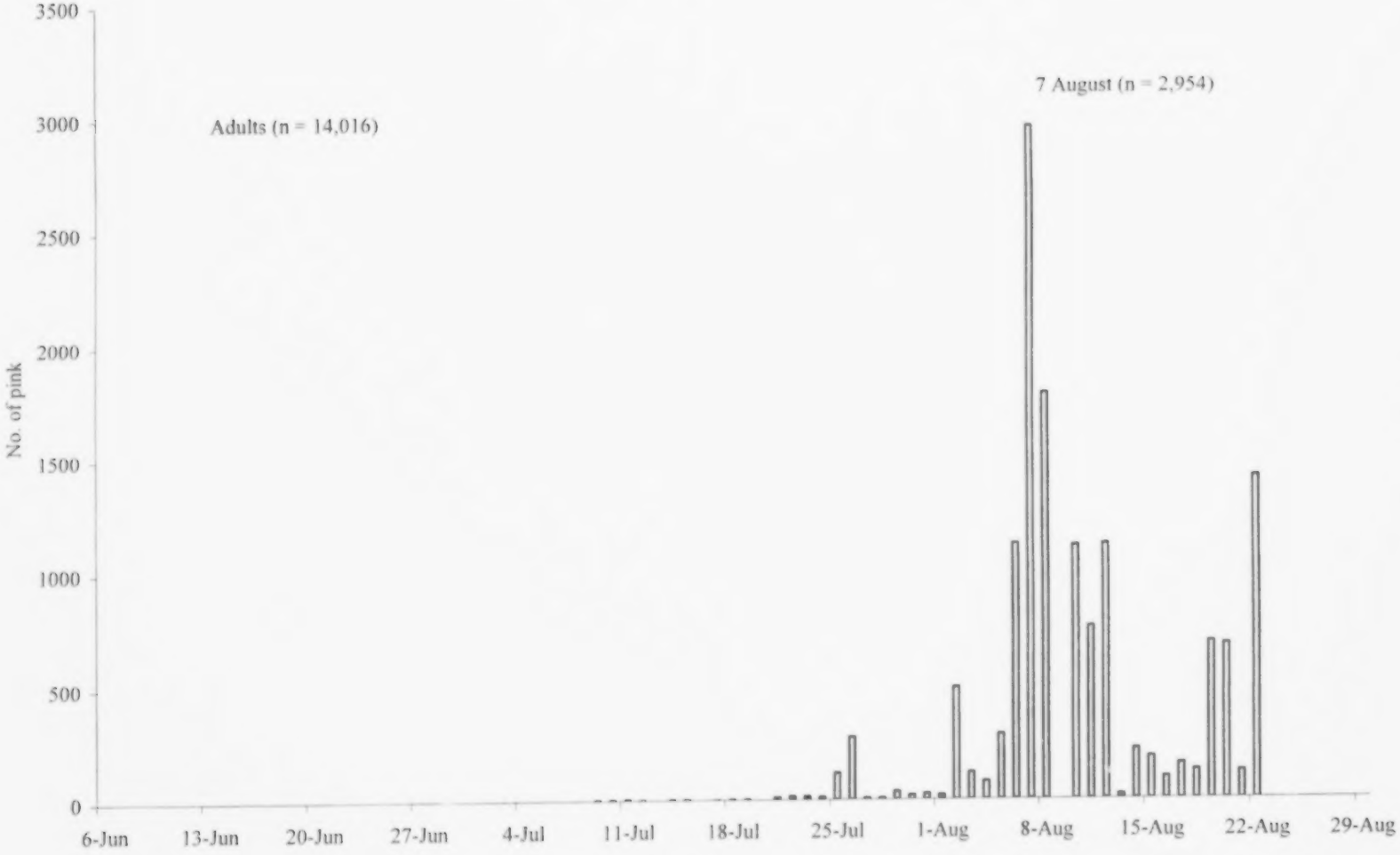
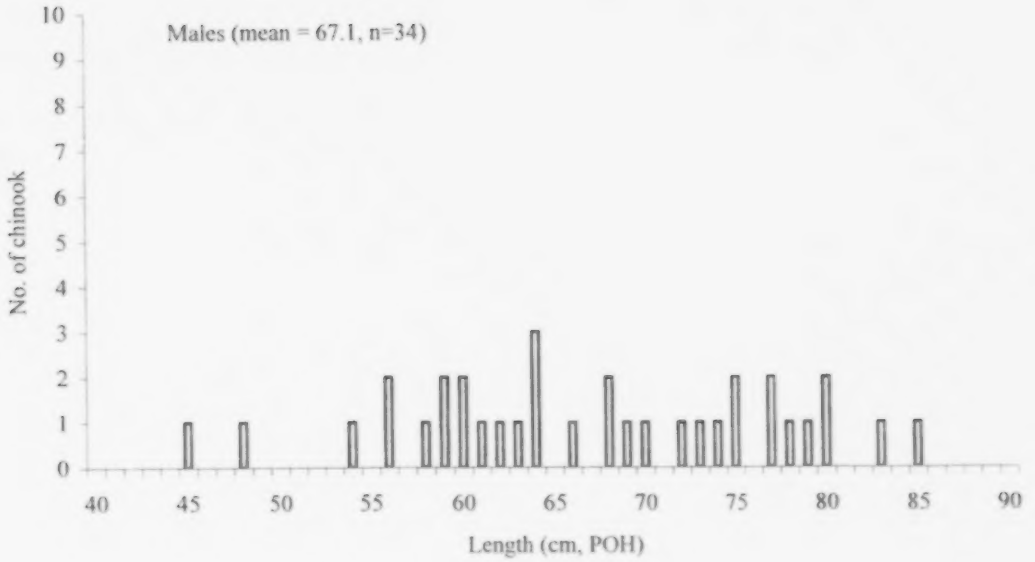


Figure 5. Daily counts of adult pink salmon at the Kincolith River enumeration weir, 6 June - 22 August, 2002.



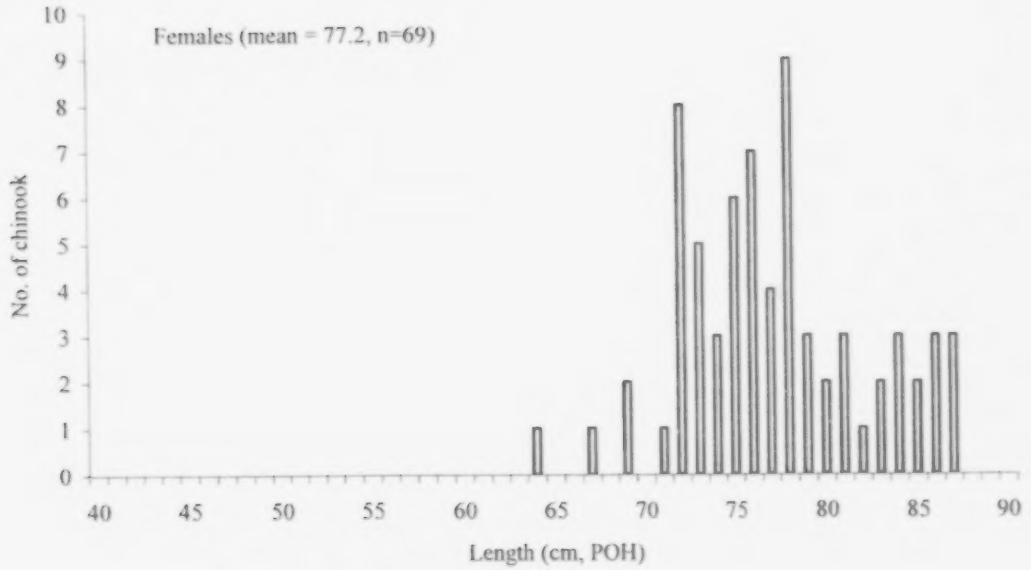


Figure 6. Length-frequency distribution of chinook, by sex, Kincolith River, 2002.

APPENDIX A

Summary of chinook mark rates at Kincolith hatchery, 1995-2002

Table A-1. Summary of mark rates of returning chinook at Kincolith hatchery, 1995-2002.

Return Year		FSC (angling)	Brood Stock Collections	Weir	Total
1995	No. Sampled	78	78	616	772
	No. aged	0	0	0	0
	No. Ad Clipped	0	9	13	22
	% Marked	0	11.5	5.8 [a]	2.8
1996	No. Sampled	98	83	112	210
	No. aged	165	0	0	165
	No. Ad Clipped	1	0	7	8
	% Marked	1.0	0	6.3	3.8
2001	No. Sampled	102	61	71	234
	No. aged	0	0	56	56
	No. Ad Clipped	6	10	17	33
	% Marked	5.9	16.4	23.9	14.1
2002 [b]	No. Sampled	103	81	980	1,164
	No. aged	92	0	0	92
	No. Ad Clipped	34	11	171	216
	% Marked	33.0	13.6	17.4	18.6

[a] The number of marked chinook at the weir was estimated by multiplying the mark rate found in the native sport fishery and in broodstock collection by the confirmed adult catch of 221 (see Alexander 1997).

[b] Mark rate at weir obtained by video.

APPENDIX B

Daily chinook counts at the Kincolith River enumeration weir, 2002

Table B-1. Chinook adult counts at Kincolith River enumeration weir, by day, 2002.

Date	Chinook
6-Jun	0
7-Jun	1
8-Jun	5
9-Jun	5
10-Jun	2
11-Jun	4
12-Jun	6
13-Jun	2
14-Jun	1
15-Jun	0
16-Jun	0
17-Jun	0
18-Jun	1
19-Jun	2
20-Jun	9
21-Jun	7
22-Jun	2
23-Jun	6
24-Jun	6
25-Jun	2
26-Jun	3
27-Jun	9
28-Jun	20
29-Jun	7
30-Jun	3
1-Jul	9
2-Jul	5
3-Jul	23
4-Jul	45
5-Jul	16
6-Jul	26
7-Jul	22
8-Jul	35
9-Jul	17
10-Jul	30
11-Jul	15
12-Jul	6
13-Jul	8
14-Jul	9
15-Jul	10
16-Jul	29
17-Jul	10
18-Jul	11
19-Jul	14
20-Jul	15
21-Jul	4
22-Jul	26
23-Jul	20

Table B-1. Chinook adult counts at Kincolith River enumeration weir, by day, 2002.

Date	Chinook
24-Jul	24
25-Jul	63
26-Jul	16
27-Jul	6
28-Jul	8
29-Jul	9
30-Jul	4
31-Jul	5
1-Aug	4
2-Aug	84
3-Aug	17
4-Aug	9
5-Aug	21
6-Aug	28
7-Aug	13
8-Aug	39
9-Aug	0
10-Aug	11
11-Aug	13
12-Aug	22
13-Aug	18
14-Aug	15
15-Aug	15
16-Aug	18
17-Aug	7
18-Aug	5
19-Aug	8
20-Aug	11
21-Aug	3
22-Aug	6
Total	1,010

APPENDIX C

Daily non-chinook counts at Kincolith River enumeration weir, 2002

Table C-1. Non-chinook counts at Kincolith River enumeration weir, by day, 2002.

Date	Pink	Chum	Coho	Steelhead
6-Jun	0	0	0	3
7-Jun	0	0	0	2
8-Jun	0	0	0	0
9-Jun	0	0	0	0
10-Jun	0	0	0	0
11-Jun	0	0	0	2
12-Jun	0	0	0	0
13-Jun	0	0	0	1
14-Jun	0	0	0	0
15-Jun	0	0	0	0
16-Jun	0	0	0	0
17-Jun	0	0	0	0
18-Jun	0	0	0	1
19-Jun	0	0	0	1
20-Jun	0	0	0	0
21-Jun	0	0	0	1
22-Jun	0	0	0	0
23-Jun	0	0	0	-1
24-Jun	0	0	0	0
25-Jun	0	0	0	0
26-Jun	0	0	0	1
27-Jun	0	0	0	2
28-Jun	0	0	0	1
29-Jun	0	1	0	0
30-Jun	0	0	0	1
1-Jul	0	0	0	1
2-Jul	0	0	0	0
3-Jul	0	0	0	1
4-Jul	0	1	0	1
5-Jul	0	0	0	0
6-Jul	0	0	0	1
7-Jul	0	0	0	1
8-Jul	0	0	0	1
9-Jul	2	0	0	3
10-Jul	2	0	0	0
11-Jul	5	0	0	0
12-Jul	1	0	0	0
13-Jul	0	0	0	0
14-Jul	2	0	0	2
15-Jul	2	0	0	0
16-Jul	0	0	0	-1
17-Jul	1	0	0	0
18-Jul	2	0	0	0
19-Jul	2	0	0	0
20-Jul	0	0	0	0
21-Jul	10	3	0	0
22-Jul	15	3	0	0
23-Jul	13	2	0	0

Table C-1. Non-chinook counts at Kincolith River enumeration weir, by day, 2002.

Date	Pink	Chum	Coho	Steelhead
24-Jul	10	1	0	1
25-Jul	115	0	0	0
26-Jul	273	2	0	0
27-Jul	6	0	0	0
28-Jul	6	0	1	0
29-Jul	33	0	0	0
30-Jul	18	0	0	0
31-Jul	23	1	1	0
1-Aug	18	0	3	0
2-Aug	492	1	10	0
3-Aug	116	2	3	0
4-Aug	77	0	5	0
5-Aug	284	2	8	0
6-Aug	1,112	1	5	0
7-Aug	2,954	0	4	0
8-Aug	1,780	3	7	0
9-Aug	0	0	0	0
10-Aug	1,104	2	12	0
11-Aug	753	2	14	0
12-Aug	1,110	9	18	0
13-Aug	18	1	6	0
14-Aug	217	5	26	0
15-Aug	182	2	23	0
16-Aug	94	6	19	0
17-Aug	153	2	20	0
18-Aug	124	2	20	0
19-Aug	686	6	29	0
20-Aug	676	8	43	0
21-Aug	118	2	20	0
22-Aug	1,407	12	73	0
Total	14,016	82	370	26

PHOTO PLATES

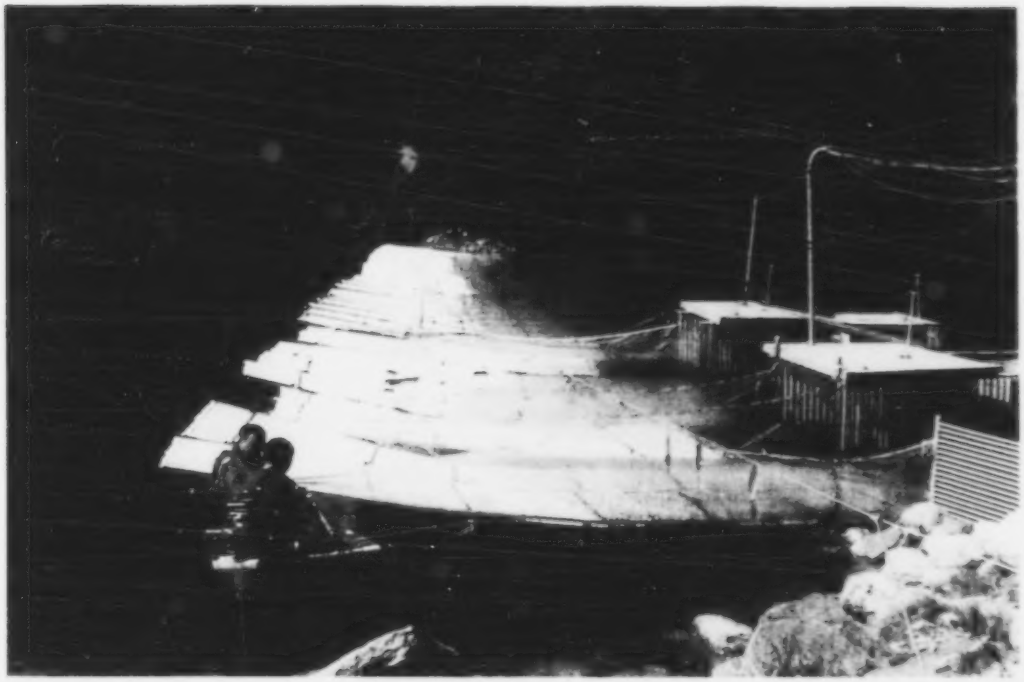


Photo Plate 1. Picture of adult weir used at Kincolith River, 2002.

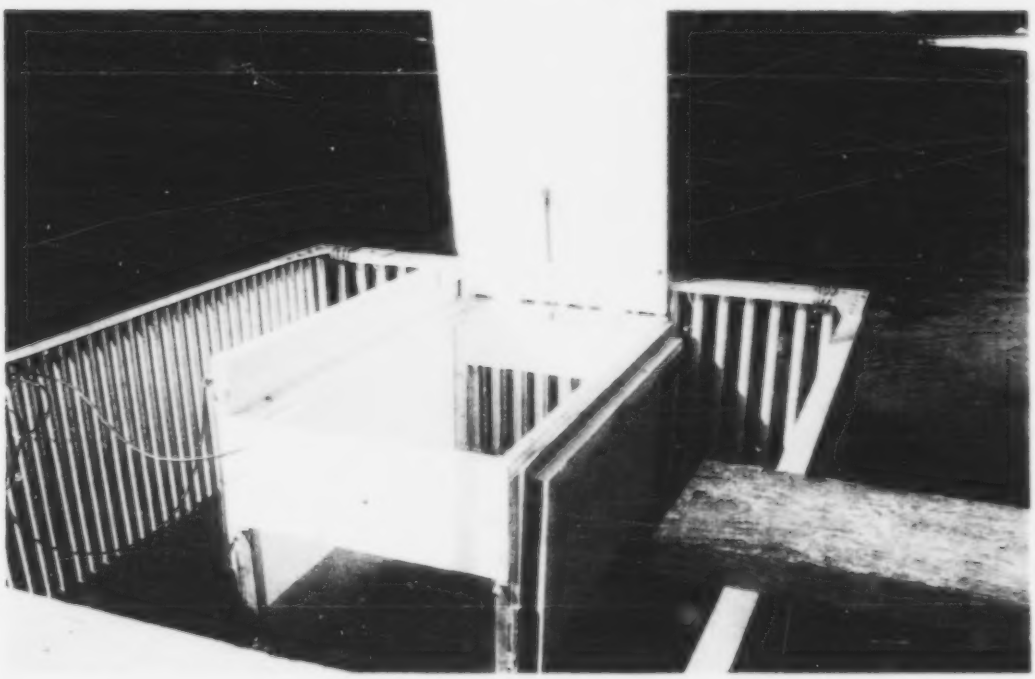


Photo Plate 2. Picture of video chamber used for enumerating returning salmon species.

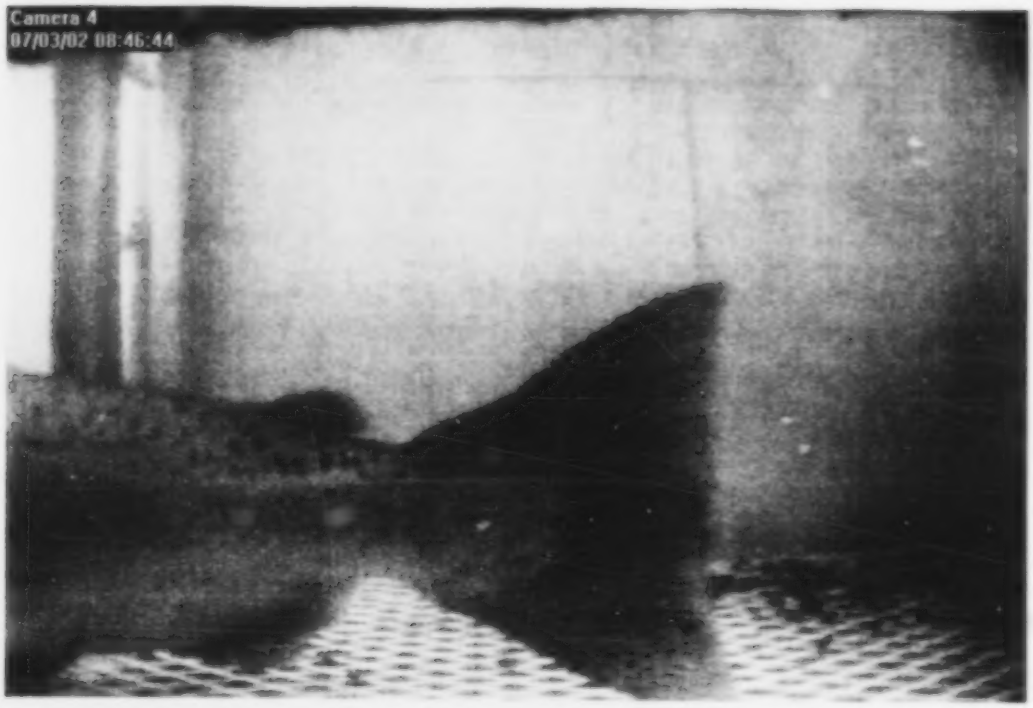


Photo Plate 3. Picture of chinook salmon with adipose fin present.

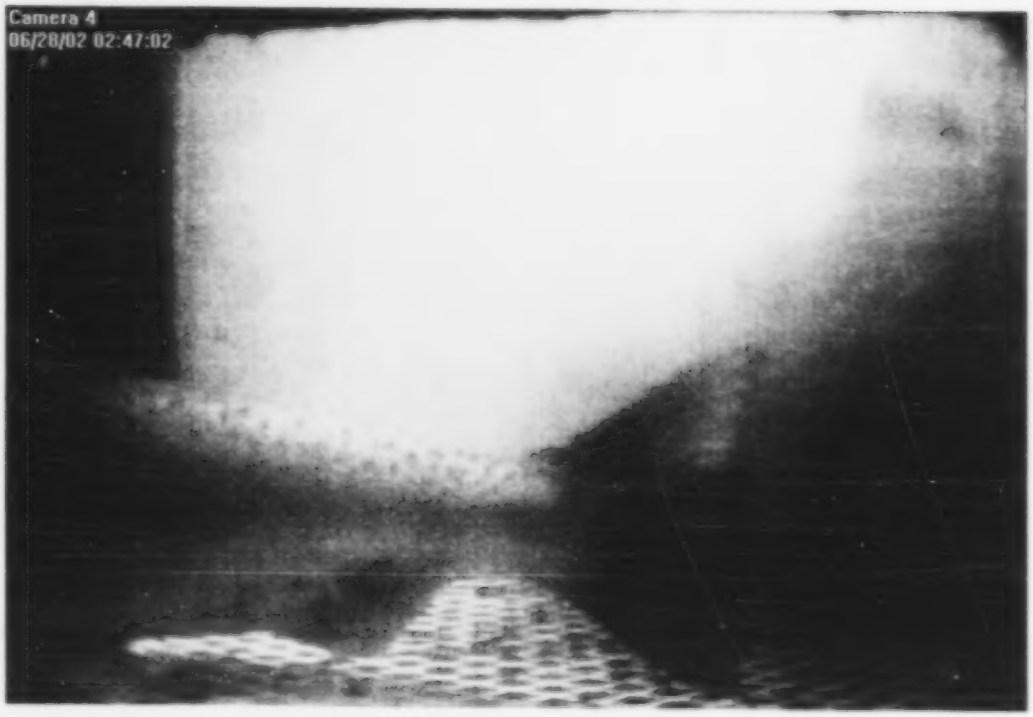


Photo Plate 4. Picture of chinook salmon with adipose fin absent.